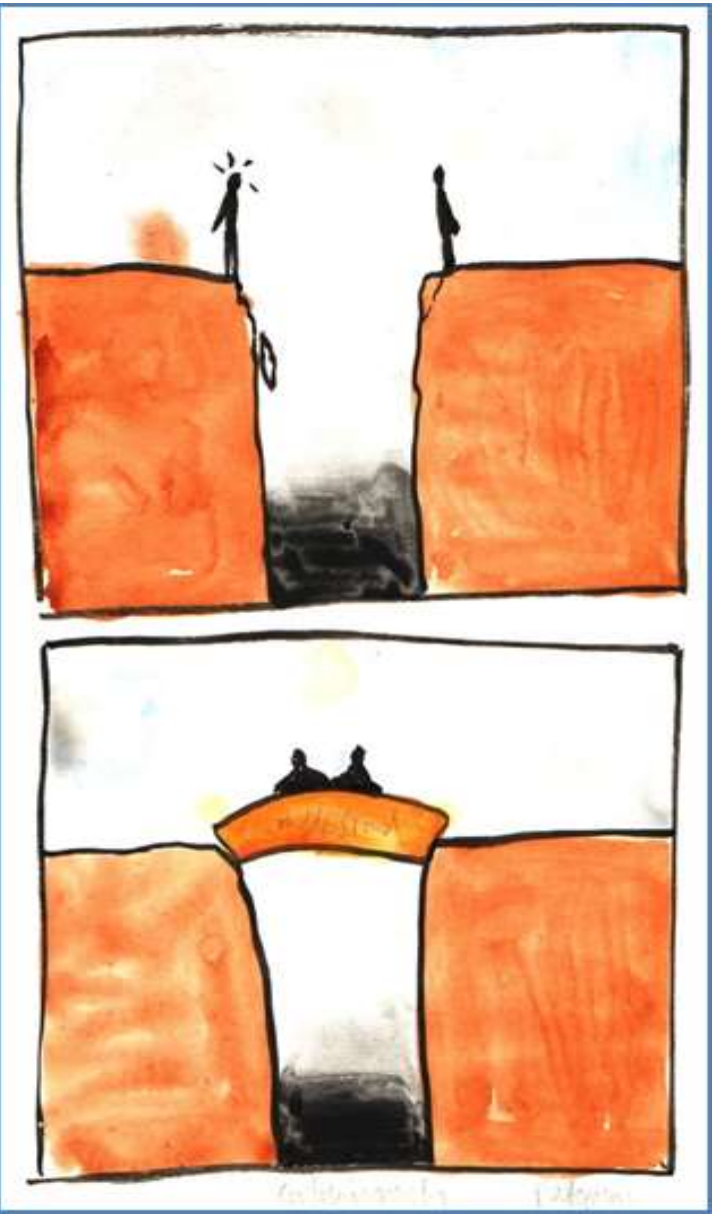
PPT for Mr Sankhe at BKC



Challenges in Indian Power Sector & Way Ahead

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Date: 17/06/2022

Agenda for today's session

- Power Sector scenario: Demand, Capacity addition
- RE capacity trend & outlook
- Coal situation in India
- Govt. initiative to address key issues, Policies etc
- Discoms financial situation & way forward
- Regulatory policies & its impact
- Outlook on Sector after the RE addition

Development of Indian Electricity Sector

- Electricity: Prime mover: Economic Development of any Nation
- First Power Station at Darjeeling on 10th Nov 1897 (3x65 KW)
- AI IC: (15th Aug 1947): 1362 MW
- 30 APR 2022: IC: 401 GW (+) (294 times)
- India: 3rd highest in Electricity Utilization : China, USA
- India's per capita per year consumption of electricity is low
  - Canada: 16,648 , USA: 11,335, Russia: 7,026, China: 5,297, India: 1,208 : World AVG: 3,316 U (2.75 times)

Power Sector Scenario: Global v/s India

- 1st: India has "fastest-growing Renewable Energy" (RE) capacity addition in the World in 2020
- Largest AC Network: One Nation, One Grid, One Frequency
- 3rd largest Coal-based THM IC in World; share (~11%)
- 4th largest RE IC; (~5% share) in the world
- India achieved 100% household electrification in 2019

Gen Sector at a Glance (as on 30/04/2022)

TTL IC: 401 GW

- **Central Gen Stations**: ISGS: 100 GW (25%)
- **State Gen Stations:** InSGS:105 GW (26.2%)
- **IPP**: CPP, Merchant Power etc: 196 GW (48.8%):Private Sector

More Energy Gen in CGS: Coal pit-mouth Stns: Less transportation

In FY 21-22, CIL supplied 622 MMT Coal to TPS

AI Import :209 MMT Coal (Steel/Iron plants/ Fertilizers & THM PS)

Source wise break-up: (as on 30/04/2022)

- THM (Coal + Lignite: 210 GW (52.4%)
- RE: 112 GW (28.0%)/ HYD: 47 GW (11.7%)
- GAS: 25 GW (6.2%)/ NUC: 7 GW (1.7%)

Source wise in Total Energy Gen FY 21-22 (1389 BU) (11% Y-O-Y rise)

- THM: 70%/ Gas: 3%/ HYD: 11%/ NUC: 3% / RE: 13%
  - RE: Target 2050 is 500 GW & 40% Energy Gen

Challenges in Indian Gen Sector:

- **Huge Coal & Gas Shortage: 10% Imported coal for Blending in FY 23**
- **Decreasing PLF: (75% in FY 2011 → 55% in FY 2021): Less DEMD in FY 20 (Covid impact)**
- **Dom Coal: High Ash content (35%), So need for Blending with of Imported coal (High CV): (Indonesia, Australia, SA, China)**
- Non-availability of Dom gas: PLF: **only 23.34% in FY 21 (APG)**
- **Private Players in Gen allowed: 48.8% capacity**

RENEWABLE SECTOR DEVELOPMENT:

RE: Wind/Solar: Intermittent, Nature-dependent, non-schedulable

- **Challenge of integrating vast amounts of RE into grid.**
- **Need: Large investments in Trans system. (RAJ, GUJ,TN,KAR)**
- **Solar & Wind: not suitable for 24X7 power supply:**
  - **Combined Hybrid systems & Need for "Energy Storage" Systems (ESS) to have 'Round the Clock' RE power. (BESS, Pumped HYD)**

Development of AI Trans Network

- 220KV/400KV/765KV EHV AC Lines; +/- 500KV, +/- 800KV for evacuation of Gen. **1200 KV UHV AC lines under testing**
- TTL T/L length in March 1997: 1,17,376 Km → 4,41,533 Km in March 21 **(3.76 times rise 24 years)**
- **Right of Way issues/Crop compensation**
- **Private Trans Players allowed (AD/JSW/TATA)**
- State Grids (1948+)/ Regional Grids (1970+)
- 30th Dec 2013: **All India National Grid: One Nation One Grid: One Frquency**

What are the advantages of Interconnections?

  - Higher Moment of Inertia (Stable system)
  - Mumbai →Maha → WR→ AI

- EMC: One NLDC: Delhi, Five RLDCs/ 33 SLDC (Computerized EMCs)
- **Two Power Exchanges**: for Day ahead, Intra-day, Real time Markets for Discoms & OA consumers, at competitive price
- **Green Power (RE) thro' PEXs: at competitive rate**

Cross Border Electricity Trade (CBET)

SAARC Agreement for Energy Cooperation: signed on 27 Nov 2014: Development of International Power Market & *Regional energy security & to promote livelihood in the area.*

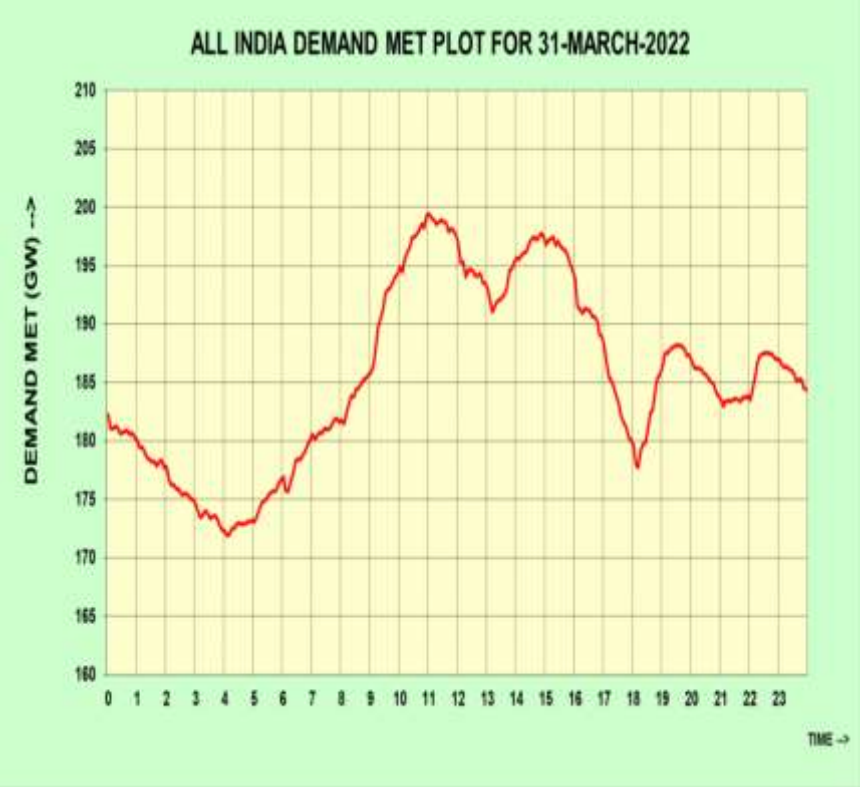
Existing Links:

- **Nepal: 16 Radial links on 132/33/11KV: 500 MW Import from India**
  - **NEA Exports 177 MW to India from 05/06/22**
- **Bhutan: 9 links: 4x400 KV, 3x220KV, 2x132KV Lines: → India**
  - **TALA: 1020 MW (UG PS 6x170MW), Chukha: 336 MW, Kurichu: 60 MW Net Import by India: up to 1500 MW , (6000 MW up to 24-25)**
- **Bangladesh: 400KV AC line: Bahrarampur (IN) - Bheramara (BD); with 500 MW HVDC at Bheramara. Net Export: 500MW**
- **Myanmar: 11KV Moreh (Manipur)–Tamu (Myanmar): 3 MW Export**
- **IEX started Cross Border Trading with retail OA participants from Nepal on 17 APR 21 thro' NVVN. Now Nepal PS selling Power to Indian Customers**

WIP: Links with Sri Lanka, Pak, Afghanistan, B'desh-Bhutan, Pak-AFGSN

Linkages with SAARC Countries

All India : Load Curve



On 29th APR 2022

Peak 1450 Hours: 207.111 GW (8 GW LS)

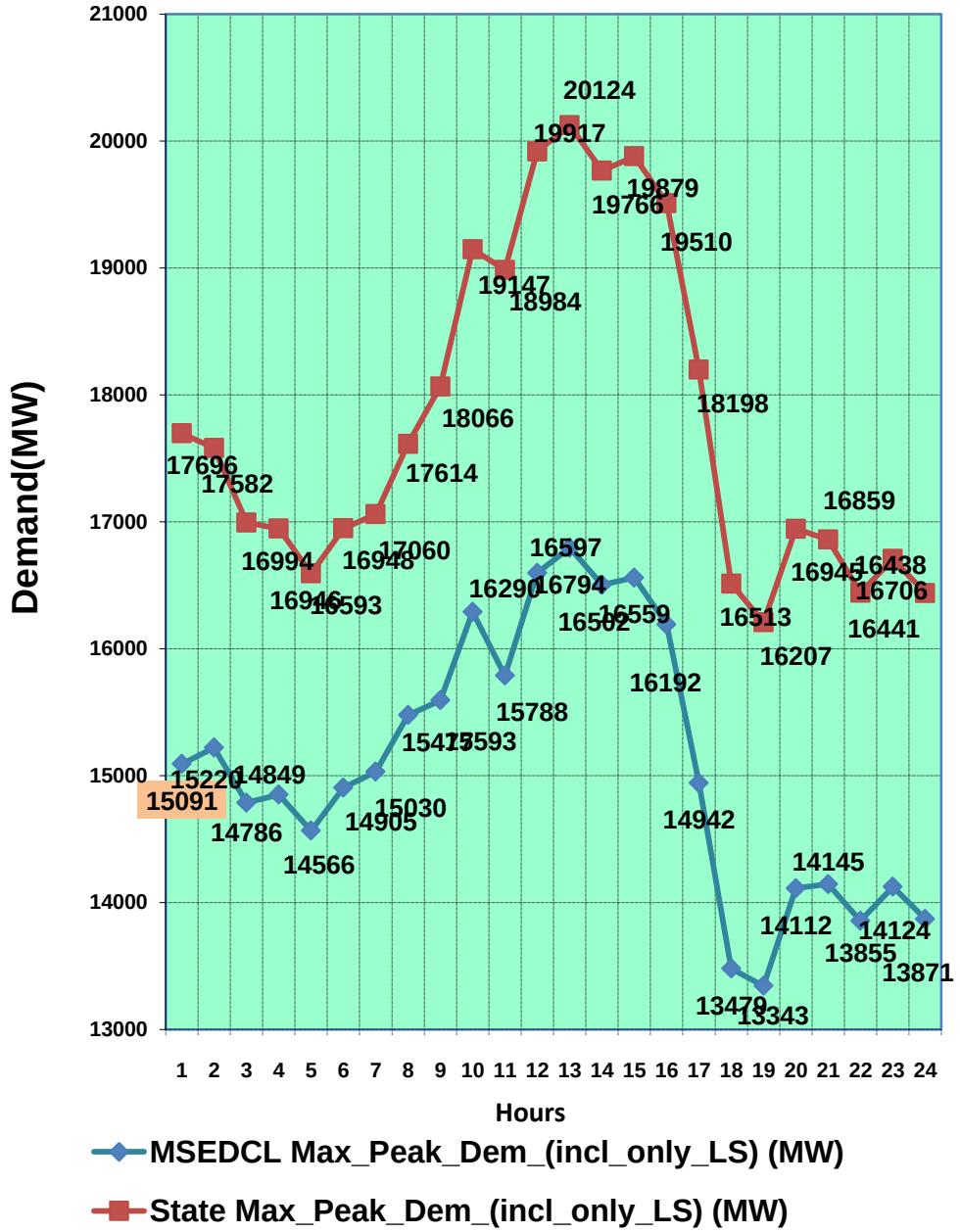
Off Peak 0330 Hours: 142 GW

EV PEAK: 2000 Hours: 188,3 GW

Energy met: 4508 MU

NOTE: PEAK Timing has Changed

MAHA: Load Curve

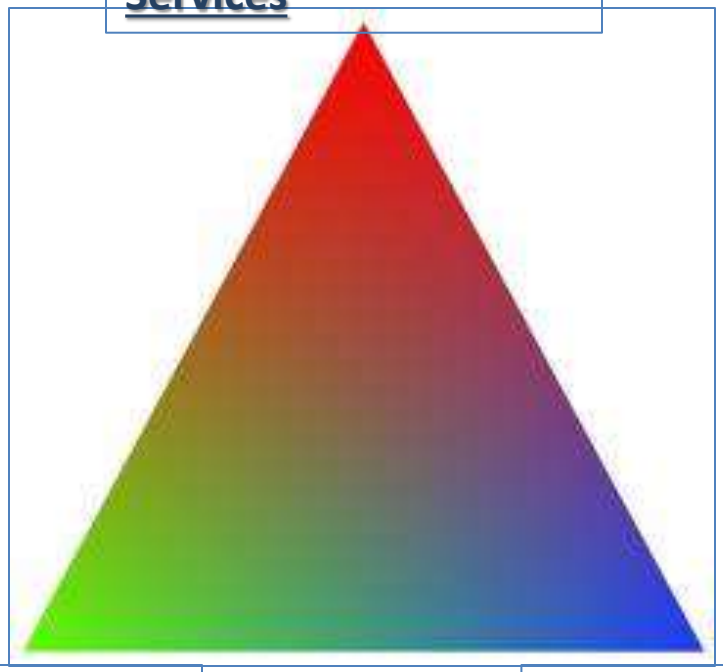


Dist System: (Most crutial link in Power sector value chain)

60% IND Load is Induction Motors

Equipments of Utmost importance: Energy Meters & Transformers

Good Quality Supply/ Services

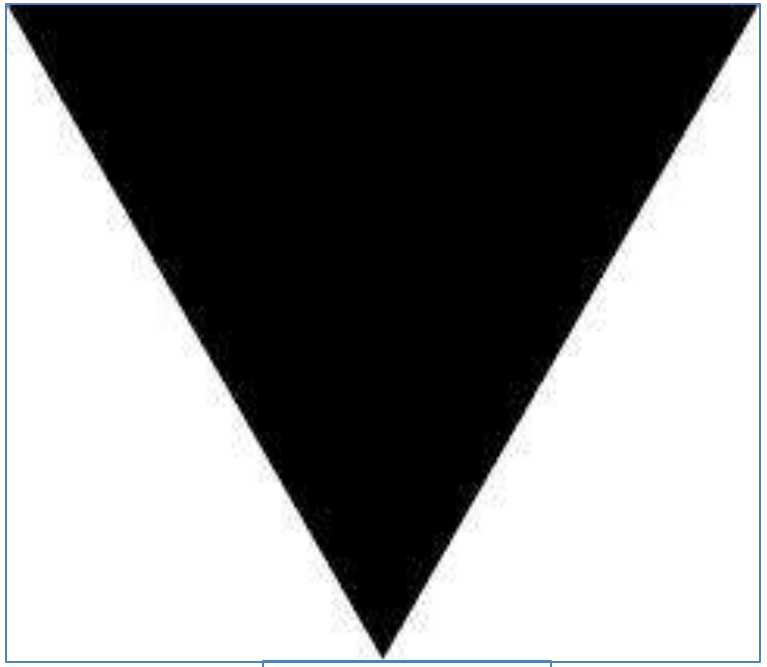


Continuity

Affordability

No Bulk Storage Possible

Switches with Consumers



Payment afterwards

Challenges in Indian Power Sector

- Fuel: Coal/Gas Shortage: 10% Imported coal (1 U: 600-700 Grms of Dom coal)
- Congestion in Trans system: More Capex
- Dist of Electricity is with Govt owned Discoms.
  - Private Sector (DL: Mumbai, Delhi, Kolkatta, Surat, Ah'bad Chandiarh, DNHDD (DL)/ Bhiwandi, Agra, Kalwa-Mumbra-Sheel (DF))
- AI Dist Losses (about 20.93%) (HI Com Losses: Theft & Hooking)
  - Billing Efficiency: 85.36%, Collection Efficiency : 92.64%
  - Unmet (AG+ Res) Consumption to be estimated (Guesstimate)
- Off Peak Load: 70% of Peak : DSM/EE/EC
- Rising % RES (INFIRM)/F&S: difficult/ Need: ESS
- Discoms dues to Genco over Rs 1.3 L CR (March 22)

Structural reforms on recasting Dist: (PPP/ DF)

  - GOI's Revamped Dist System Schemes (RDSS): Rs 3.05 Lakh CR investment in 5 years
  - Demand emerging: EVs
  - Stressed assets: 40 GW THM plants: No FSA/PPAs
- Market development: Two PEXs (DAM,TAM,GTAM, RTM, REC)
- Cross-border trade (Nepal/ Bhutan/ BDesh/ Mynamar)
- Free Electricity: upfront payment of Subsidy by (as per S65) of EA 2003 State Govt to DL/ Rise in Comm Losses (???)

Present AI Power Sector: Some Basic issues

Availability of electricity is less, the Nation is under deep trouble.

Power supply position as on 30 APR 2022:

- **TTL Installed Gen capacity : 401 GW Demd: 211.856 GW (on 10th June 2022) at 1447 Hours. Energy: 4,800 MU. Peak deficit was at 578-MW, while the energy shortage was 21 MU.**

Installed capacities:

- **Coal + Lignite based Gen capacity: 210 GW: *Most dependable source, due to severe coal shortage Gen availability is down to 140 GW***
- **Gas based Gen: 24.9 GW (6.9%): Low availability of Administered-Price Gas**
- **Large Hydro Gen capacity: 46.7 GW (11.7%): Low availability in summer**
- **Solar Gen: 54 GW (13.5%): Available for 10 hours (daytime)**
- **Wind Gen: 40 GW (10.1%): Max availability during end May to end Sept**
- **Biomass Cogen: 10 GW (2.6%): depends on fuel availability (biomass)**

Indian Power System is highly dependent on Coal based THM Gen (Dom as well as Imported Coal).

- **Main Reason for Energy Shoratge in Apr/May 22: Sweltering Summer & Acute Coal shortages for TPS**
  - AI consumers facing **Power cuts ranging from 2-8 hours**
  - Mumbai DEMD crossed over **3700 MW** & Delhi Demd: 7070 MW at 1124 Hours on 19th May 22 (Hi Humidity → Higher use of AC)
- **AG & IND → Worst hit as first port of call ,for LS in 16 states**
  - **Extreme heat in March/April/May 22:** power Demd all-time HI.
  - **Low Coal supply to TPS which generates 70% of India's electricity**
  - **Reduced availability of RLY rakes to transport Coal to TPS leading to shortage of coal inventories *(lowest levels in at 9 years)***
  - **Russian invasion in Ukraine**: Imported shooting up (US$ 60 to US$ 250-300 per MT) (Rs 20,000/MT)
  - **Coal imports have drastically dipped. Russia provides Oil/ Coal to EU**
  - **AI** Peak Demd met or highest supply in a day was over 207 GW at 1450 Hours in AN **(AC Demd rising) on 29th APR 2022 & 212 GW on 10th June 2022)**

Coal Stocks:

- Latest CEA data (1st Week June 22) shows that 147 non-pit head plants with total capacity of over 163 GW had only 50% of normative coal stocks. (28 MMT coal in stock: Norm of 57 MMT)
- Due to coal shortages at THM plants, In may 22, GOI revised limit for imported coal from 4% of coal requirements for blending to 10%, for 3 years.
  - Further in June 22, GOI revised it to 15% imported coal for blending

Power Market:

- In FEB /March Max rate at PEX touched earler cap of Rs 20 PU, many a times: Dealyed action.
  - PEX rate was high during elections & higher due to Dom coal shortages
- PEX cap was revised to Rs 12 PU in APR 22
  - PEX "Buy" bids are 4-6 times more than "Sale" bids. Hence, AVG PP price at PEXs is over Rs 9 PU with Peak time pricing at the capped price of Rs 12 PU.

- ***Delayed action means costly imports, & more energy bills to consumers. Responsibility (??): inefficient planning***
- **Mumbai Grid failed on 26 APR at 1015 Hours as 400KV Kalwa-Padghe lines tripped (which were bringing power for Mumbai City), leading to power outages in several parts of Mumbai City & MMR.**
  - **Fault occurred at 400 KV Padghe S/s due to which 400 KV Padghe-Kalwa lines 1&2 feeding Mumbai tripped. Repairs work was expedited & the lines were resored by 1108 Hours (within 53 Mins)**
- **After a month of severe coal shortage, leading to load shedding in 16 States in India, finally to avoid full-blown power crises,**
  - **Indian RLYs cancelled some 42 Passenger Trains to enable faster movement of Coal wagons to improve depleting Coal Stocks at THM power plants Action delayed by Authorities.**
  - **Poor coordination Is common man responsible for this??**

- **Sec 11 of EA 2003 provides that Govt may, in extraordinary circumstances, ask a Genco to operate & maintain any station in accordance with Govt's directions, which ensure Fuel Cost Pass through (FAC) for Gencos.**
  - **GOI has evoked this provision for allowing import of Coal to IPPs & allowing purchase pf power at higher rate than quoted & agreed in PPA till Dec 2022 (Mundra UMPP (3x800MW) for GUJ/Maha & 1400 MW power by HAR from 2x800 MW, balance can be sold in PEX)**
  - **KAR has also agreed to allow complete Coal cost pass-through to Adani Power's 1200-MW Udupi Power till Dec, with a provision to exit from the arrangement in Nov**
- **Suprisingly, in 2017, India declared itself as "Energy Surplus Nation", assuring that there will be no more LS days because of "Proactive Policies". Unfortunately, within 5 years the boasting proved to be wrong,**
  - **We started many Energy savings/ Energy Efficiency/ Energy Conservation/ Demand Side Management Programs. Why there are no visible result of these programs, when system is passing thro' a very critical situation?**
  - **Whether "These Programs" only for Events/ Seminars/ Webinars/ HI level conferences , where many things only to be spoken & no follow up action needs to be taken. Many Ads in News papers without any followup action**

- More than two month long disaster shows; we need have a full-time co-ordination at various levels (Coal Dept/ Railways & Power/ Energy Depts/ IMD, instead of passing the BUG. Regulators presence was not seen in this event.
- "Free Electricity" is a misconception. Anything free is bound to be wasted & has to paid by somebody. It has become an election winning stategy, by all parties We all need to think seriously on it. When something is given FREE, YOU are the PRODUCT.

As per S65 of EA 2003:

- If the State Govt requires the grant of any subsidy to any consumer or class of consumers in the tariff determined by SERC uS 62, State Govt shall, pay, in advance to compensate the person affected
  - No such direction of the State Govt shall be operative if the payment is not made in accordance with the provisions contained in this Section & tariff fixed by SERC shall be applicable. But mormally subsidy payment is delayed .

Lessons learnt from the crisis:

- To ensure transparency & consistency, we need to do better system planning, including better estimation of Demd & planning reserves.
- Two, we need to ensure that Green technologies: RES, Battery Storage & Green H2 are maximized in energy system via appropriate policies. Investors expect a transparent, long term & Consistent policies (of late, there are frquent changes in Policies) These measures include mandatory portfolio targets & incentives such as accelerated DEP, Viability Gap Funding & Interest-free loans
- Three, we need to ensure that THM plants are incentivized to provide flexible capacities. Adequate Revenue realization is a key starting step. Utilities need to be incentivized thro' TOD pricing on consumers. Honouring capacity contracts would ensure TOD availability, of coal power including during demand surges.
  - Finally, Dom coal production needs to be improved along with improved transportation of coal to THM PS

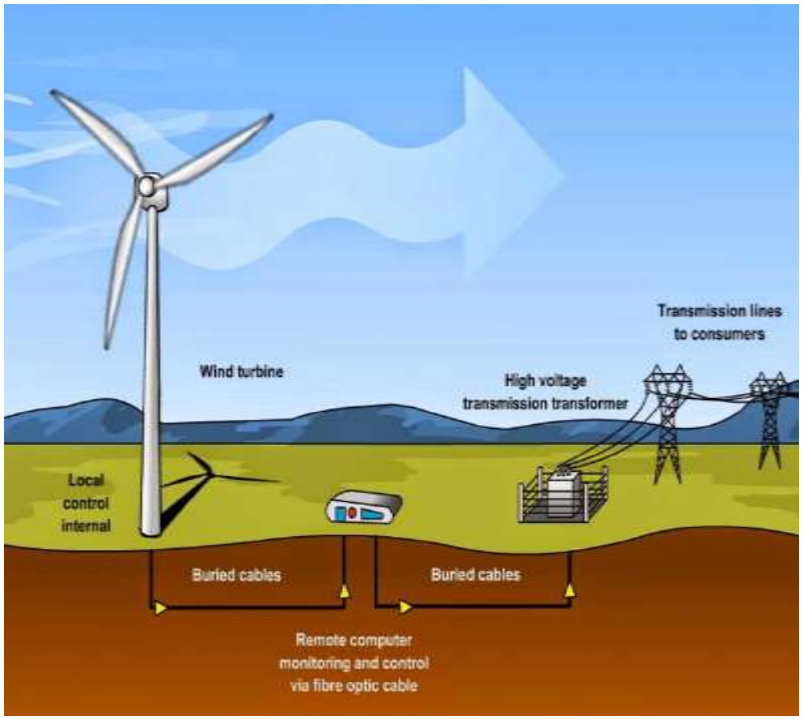
How various types of Renewable Energy work?

Solar energy:

- **Sunlight is one of our planet's most abundant & freely available energy resources. Amount of solar energy that reaches the earth's surface in one hour is more than the planet's total energy requirements for the entire year.**
- **Although it sounds like a perfect RE source, the amount of solar energy we can use varies according to the time of day & the season of the year as well as geographical location.**
- **In India, solar energy is an increasingly popular way to supplement our energy usage. (Grid connected , Solar Rooftop, Solar AG feeders, Off grid Solar)**

Wind Energy:

- Wind is a plentiful source of clean energy.
- Wind farms are an increasingly familiar sight in India with wind power making an ever-increasing contribution to our National Grid.
- To harness electricity from wind energy, turbines are used to drive generators which then feed electricity into the Grid.
- Hub heights, Rotor diameter increasing: 2.4 MW Gen sets (120 Met hub height) are available for retofitting 150-250 KW wind turbines with (30-45 Met hub height wind turbines)



Small Hydro Energy:

- As RES, HYD power is the most commercially developed system. By building a dam or barrier, a large reservoir can be used to create a controlled flow of water that will drive a turbine, & generate electricity.
- This energy source can often be more reliable than solar or wind power & also allows electricity to be stored for use when Demd reaches a peak. (Pumped Storage)

As per MNRE's RE Policy, HEPs generating less than 25 MW are termed as Small HYD

Bio-mass Energy:

- This is conversion of solid fuel made from plant materials into electricity. Although fundamentally, Biomass involves burning organic materials to produce electricity, & nowadays this is a much cleaner, more energy-efficient process. By converting AG, IND & domestic waste into solid, liquid & gas fuel, biomass generates power at a much lower economic & environmental cost. (Ground nut shell being used as a fuel)

Govt Policy initiatives For Promoting RE Gen

- Norms for Renewable Purchase Obligation (RPO): mandatory 19.5% PP from RES (for FY 23)
- Foreign Direct Investment (FDI) up to 100% thro' automatic route for RE Projects
- Waiver of Inter State Trans System (ISTS) charges on Trans of Electricity generated from Solar & Wind power for projects commissioned any where in India up to 30th June 2025
  - Generate Solar Energy in RAJ & use it in Assam: No ISTS charges
- Standard Bidding Guidelines (SBG) to enable Discoms to procure power at competitive rates (Solar: Rs 17→2 PU)
- Framework for Renewable Energy Certificates: in case RE is not consumed in the State, where it is generated, REC market in PEXs (e.g. excessive RE in GUJ/RAJ/ TN/KAR)

MNRE's RENEWABLE ENERGY Policy

- RE (Solar/Wind/Bio-mass-Bagasse Cogen/ SHYD/ WTE: MSW) rising faster pace Present 111 GW. Target: 500 GW of RE by 2030
- GOI & all State Govt have devised PROACTIVE RE Policies
- As on 31st March:
  - 1997: 902 MW, 2007: 7760 MW, 2017: 57,260 MW,, 2022: 112 GW (124 times rise in 25 years)
- FY 2021-22 RE Gen: 13% of AI Gen (14.1% in May 22)
  - *AI RE IC*: Wind: 41 GW, Solar: 55 GW, SHYD: 5 MW, Biomass & Bagasse Cogen: 10 GW, WTE: 476 MW
  - Top 6 State RE 78% IC: KAR (18,543 MW)/ TN (18,638MW / GUJ/ Maha (14026 MW)/ RAJ / AP

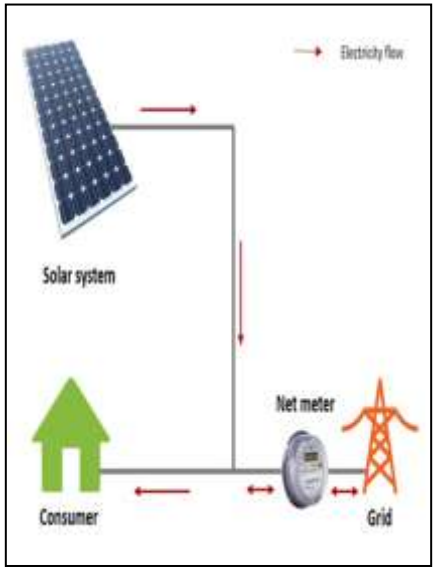
With change in Tech in Solar/wind Gen, tariffs have come down: Solar tariff: Rs 17 PU → Rs 2 PU. Wind: Rs 7 PU → < Rs 3 PU)

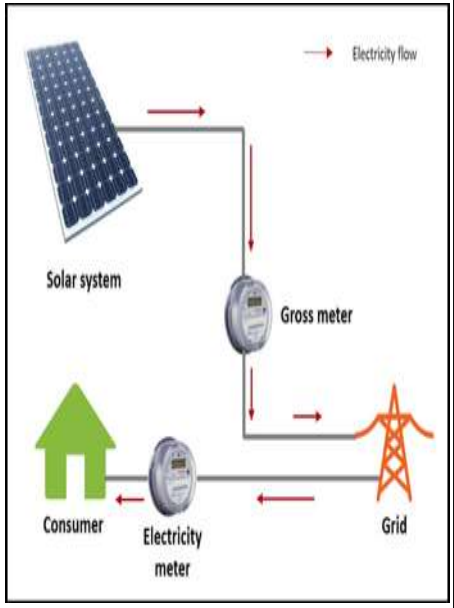
AGRIVOLTAIC System by JAIN Irrigation, Jalgaon

Solar Schemes:

- **PM Kusum Yojana**: Ensuring **energy security to AG sector**
- Setting up of 10,000 MW Grid Connected RE Plants on Govt **barren land or unused farm land**
    - **500 KW to 2 MW RE power plants (REPP)** :Setup by farmers/ Co-ops/ GPs **on barren/ fallow land**.
  - Solar Plants: installed **on cultivable land on stilts where crops can also be grown below solar panels. (Agrivoltaic Scheme)**
  - Solar panels on Canal: reduing water vaporization
  - Power to be purchased by local DISCOM at **pre-fixed tariff for 25 years (PPA)**

Roof Top Solar PV: Metering





Rooftop: **Reduces requirement of land:**

- **PROSUMER Concept: PROducer + ConsuMER**
- **India's cumulative RT solar capacity reached 7.6 GW by March 22**
- **Net-Metering: RT Solar PV system, with a net meter (Import/Export) installed at consumer premises.**
  - **Delivery of excess Energy to DL, after setting off quantum supplied by DL**
  - **For over-injection during FY: DL to provide credit equivalent to amount payable. At the end of FY, net excess energy, shall be purchased by DL**
- **Gross metering: Two Meters one for Gross Gen T other for Gross consumption by consumers**
  - **Consumer compensated at fixed tariff for total units of solar energy generated & exported to grid (accounted by a 'Gross meter')**
  - **Consumer has to pay to Discom at retail supply tariff for energy consumed from grid:**
  - **Gen tariff is lesser & retail supply tariff rate is higher**

Solar park Scheme:

- **Assured availability of Govt land, & evacuation systems**
- **To bring in more investment from project developers, meet its RPO mandate, increasing employment opportunities to local population**
- **Waiver on ISTS charge for RE gen till June 30, 2025**

TOP-5 Solar Parks in India:

- **Bhadla Solar Park: 2,250 MW Biggest in Asia (Jodhpur Dist in RAJ)**
- **Shakti Sthala Solar project: 2,050MW** (Tumakuru Dist KAR)
- **Ultra Mega Solar Park: 1,000MW. (Kurnool Dist AP)**
- **Rewa Solar Project – 750MW (Rewa in MP)**
- **Kamuthi Solar plant: 648 MW (Ramanathapuram Dist, TN)**

Maha's proposal for six Solar parks in Maha (6x100MW): Land requirement : 4-5 Acre/MW & getting 600 MW Solar Energy from ReNew Power in RAJ

Repowering India's top Wind Sites could add 30 GW:

- **Wind sector is moving at a slow pace in last 4 years**
  - **Delay due to Land availability & acquisition most critical**
  - **Sites with top Wind Power Density (WPD) of above 300 (W/m) & wind speeds above 6.4 m/s are limited (located in TN & GUJ)**
  - **10.5 GW Wind Gen have already been commissioned there, with wind turbine sizes < 1 MW. With older turbines occuping top wind sites**
- **Repowering older wind turbines with modern turbines of 2-3 MW capacity could boost India's wind Gen**
  - ***30 GW new capacity will be available***

Wind turbine technology improved in last decade.

- **Rotor dia of modern turbines are up to 140 m (80-100 m)**
- **Hub heights have increased to up to 160 met (60-100 met)**
- **Modern turbines provide better availability of about 98%.**

Combining all these, would improve CUF from 18-23% to 35-40%

Renewable Purchase Obligations (RPO)

(Quantum of PP by DL (in %) from RES in Equivalent KWH)

FY	Solar RPO	Non-Solar RPO	Total RPO
2020-21	4.5%	11.5%	16.0%
2021-22	6.0%	11.5%	17.5%
2002-23	8.0%	11.5%	19.5%
2023-24	10.5%	11.5%	22.0%
2024-25	13.5%	11.5%	25.0%

Energy Storage Systems

- Need to reduce Carbon emissions → by introducing RES.
- However, RES being intermittent in nature, pose a great challenge in providing 24 x 7 Electricity Gen & Manitain LGB to ensure Power Network Stability & Reliability.
- More RE → Grid requires Energy Storage Systems (ESS): most promising alternatives.
- Batteries are in use as a simple Energy Storage device.
- Pumped Hydro Storage (PHS) has a distinct advantage due to the possibility of providing Large MW scale Energy Storage, no pollution, no use of undesirable material like those in Batteries, easy technology & operation. 10 GW PSS is required by 2030. Tariff for RE+ PSS: Rs
  - Ghatghar PSS (2x125 MW) in Maha
  - Greenko Group has commenced construction of 5.23 GW Integrated RE Storage Project in Kurnool Dist AP.
  - It will comprise pumped storage capacity of 10,800MWh per day, 3GW of solar capacity & 550MW capacity of wind power

Battery Energy Storage Systems

10 MW BESS at Rohini S/S TDDPL commissioned In Feb 2019 South Asia's Largest BESS

ESS: HI CAPEX: Pumped Storage HEP/ Li-Ion Batteries

- GOI's ES Mission: 15 GWH ESS to be commissioned within next 5 years

- Battery storage ESS (10 MW) (*AES Corp. & Mitsubishi Corp)* commissioned by TPDDL at Rohini S/S to help network operators:
  - To mitigate Variability of RES
  - To reduce congestion on Trans system
  - To help to address challenges in peak Load Management

"National Hydrogen Mission (NHM)"

- NHM needs huge investment from Public & Private sectors
- Hon PM In his speech, on 15th Aug 2021 highlighted that India spends more than Rs 12 Trillion in a year ($161.3 Bn) on importing Energy fuels. "For India's progress & to build a self-reliance, India's Energy Independence is the need of the hour".
- H2 is going to make a significant contribution towards decarbonisation as well as, making India self-sufficient in energy,
- NHM initiative will capitalise on one of the most abundant elements on earth (H2) for a cleaner alternative fuel option.

Type of Hydrogen:

- Grey Hydrogen: Extracted from hydrocarbons (fossil fuels, Natural gas).
  - Black H2: using Black coal as a feedstock.
  - Brown H2: produced from Brown coal (i.e. Lignite).
- Blue Hydrogen: Sourced from Natural Gas
  - Pink H2 produced thro' electrolysis,using energy from NUC PS
- Green H2: Generated from RE (like Solar, Wind).
- Electricity splits Water into H2 & O2 thro' Electrolysis process:
  - (By Products : Water, Water Vapor)
- Cleanest way to produce H2. That's because there are no carbon emissions in the value chain.
- NHM: Focuses on Gen of H2 from Green power resources
- Green H2 production can serve as a primary off-taker for excess RE, there by enabling max development of RES
  - Steep decline in electrolyzer costs
  - Lower tariffs for Solar will help H2 to be produced at a lower cost.

RDSS: Revamped Dist Sector Sheme: Reforms-Based & Result-Linked

- **GOI's Revamped Dist Sector Scheme (RDSS): to help DISCOMs improve their operational efficiencies & financial sustainability by providing result-linked financial assistance to DISCOMs to strengthen supply infrastructure based on meeting pre-qualifying criteria & achieving basic minimum benchmarks.**
- **RDSS has an outlay of Rs 3,03,758 CR over 5 years i.e. FY 2021-22 to FY 2025-26. Outlay includes an estimated Govt Budgetary Support (GBS) of Rs 97,631 CR.**

REC & PFC are as nodal agencies for facilitating the implementation of the scheme. RDSS aims to meet the following objectives:

- **Reduction of AT&C losses to pan-India levels of 12-15% by 2024-25.**
- **Reduction of ACS-ARR gap to zero by 2024-25.**
- **Improvement in the quality, reliability and affordability of power supply to consumers through a financially sustainable and operationally efficient distribution sector.**

RDSS has following components:

- **Part A: Financial support for Prepaid Smart Metering & System Metering & up-gradation of Dist Infrastructure.**
- **Part B: Training & Capacity Building & other Enabling & Supporting Activities.**

Learning from the experience of previous schemes, the RDSS has been developed to address state-specific needs. Some of the salient features are as below:

- **Prepaid Smart Metering to be prioritized for**
  - **500 AMRUT cities, with AT&C Losses > 15%**
  - **All UTs**
  - **MSMEs, Industrial & Comm consumers**
  - **All Govt offices at the Block level & above**
  - **Other areas with high losses**
- **Prepaid Smart metering for remaining consumers & areas is proposed to be taken up by DISCOMs in a phased manner. Prepaid Smart metering & system metering are proposed to be implemented thro' PPP on TOTEX (CAPEX+OPEX) mode.**

- **Part A of scheme also provides financial assistance to DISCOMs for infrastructure creation and undertaking reforms to achieve the desired results towards improvement in operational efficiency & financial sustainability.**
- **Provision of feeder segregation for unsegregated feeders. Thereafter these feeders are to be solarized under KUSUM: leading to cheap/ free daytime power for irrigation.**
- **Pre-qualifying criteria need to be mandatorily met with DISCOMs before they can be evaluated based on the Result Evaluation Matrix.**

Thereafter, performance based on Result Evaluation Matrix shall form the basis for the release of funds under the scheme.

- **For Prepaid Smart metering, a grant of Rs 900 t0 1350 per consumer meter shall be available**
- **To incentivize the States/UTs to fast-track installation of prepaid Smart Meters by Dec 2023, an additional incentive of 7.5% of cost per consumer meter or Rs. 450 (whichever is lower) shall be available.**
- **For works other than Smart Metering, max financial assistance given to DISCOMs will be 60%-90% of the approved cost,**

Smart Meters (SM)

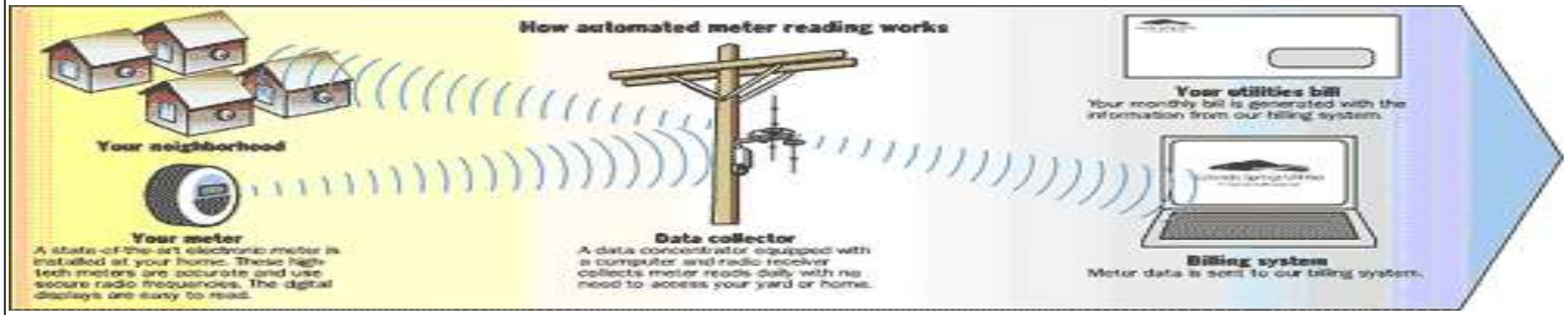
- **Smart Meter: Static Energy Meter with 2 way communication capability**
  - **having TOU Registers, Internal Connect & disconnect switch (Contactor (relay)) to disconnect supply of customers who do not pay Bills.**
- **To measure energy, & communicate readings (Energy, PF, Q, V & Freq): Remote metering, Billing**

Smart Meters DO NOT save energy. (People Do)

- **SM remotely monitors Consumption pattern**
- **Using an in house display unit, Smart Meters' can change customer behaviour. Customers can save energy thro' increased awareness**

Smart Metering Systems

- **Smart Meters: Bidirectional Comm needed**
  - **Remote Connect/Disconnect for Load Control (of customers not pay their bills): Meter contains *a large contactor (relay) that disconnects or reconnects customer from the system* / suitable for TOU Tariff**
- **AMR : Most widely implemented Smart system. (>20 KW)**
  - ***Meter data is rapidly & accurately collected.*** **No manual intervention in Meter reading**
  - **Helps customers to better understand their consumption & plan their usage accordingly.**



Advantages of Smart Metering system:

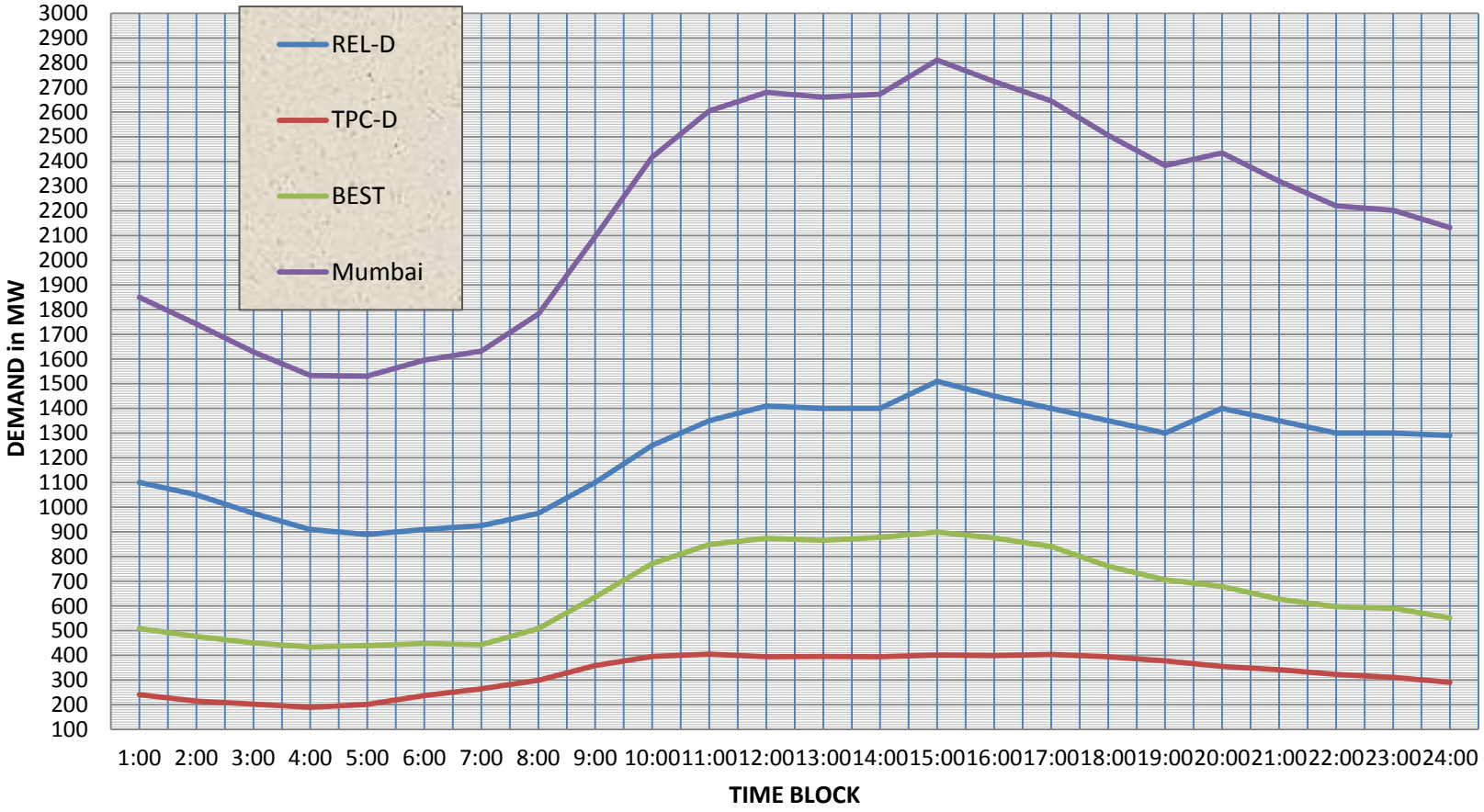
- AMR: Unidirectional Comm, SM system bi-directional Comm
- SM: Supports Prepayment ("Top-Up" facilities) TOD Tariff
- Capability of giving Consumption Statements to Consumers
- Roof Top Net metering is feasible
- Record of Outage/Restoring: is kept: Monitoring PQ
- Remote Real time Tamper detection:
  - In case of meter tampraing, SM sends signal to Meter Data Management System, which sends alerts to Cotrol room operator. Alerts also appear on meter screen
- Load Determination for Demand Response (DR) application (DL requesting cosumer to reduce load, consumer reduces it & is financially gets compensated. Consumer: Virtual Gen

Cyber Security of Metering system is a challenge

TPC & AEML has also launched a Smart Meter installation program for Consumers in Mumbai with > 300 U/Month

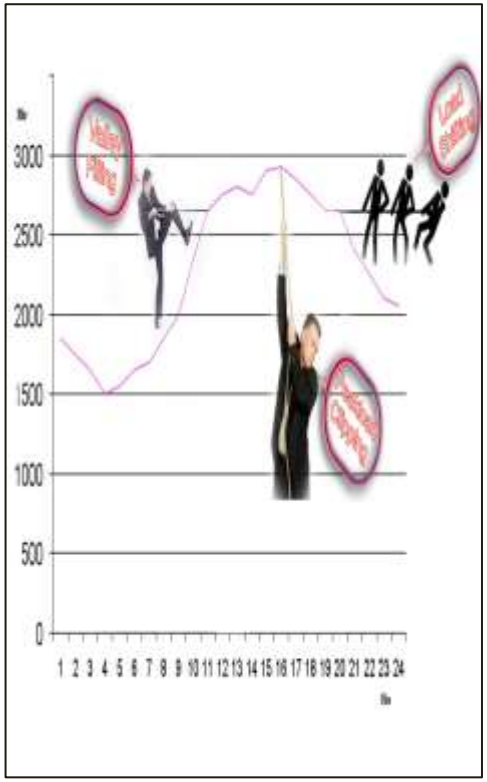
Mumbai Load curve: Typical day

(For Mumbai Distribution Utility & Consolidated Mumbai)
(Peak Mumbai Load: 3469 MW)



About 35-40% Peak Load in Mumbai is due to Air Conditioning Load

Demand Response : Mumbai Case study



- Mumbai Peak: 3400MW Min Load: 2200 MW
- **AC Load:35-40% of Peak Load (1530-1630 Hours due to High Humidity)**
- Short term PP has great impact on Mumbai's retail tariff. Need for Peak Load reduction.
  - Mumbai (09-10) : PP Cost: > Rs.8 PU for 100 Hour With 10% Dist loss Cost at consumer end: Rs 8.90 PU
  - **Comm. tariff: Rs 5.50 – 6.00/ KWH**
- Instead of increasing PP: Aggregator calls for a Demd reduction by consumer to balance system Demd & Consumer gets compensation for L/R (managing A/C Loads)
- *BKC Area: about 50 Consumers with DR capabiity of 2 MW each:* Incentive: Rs 2.25 PU saved
- India's first pilot DR program for Com & IND sectors by TPC (12 MW Virtual Power plant)

DR Actions:

(Negawatt: unit of power that is no longer needed)

GRID STRESS → Notification → Client Actions

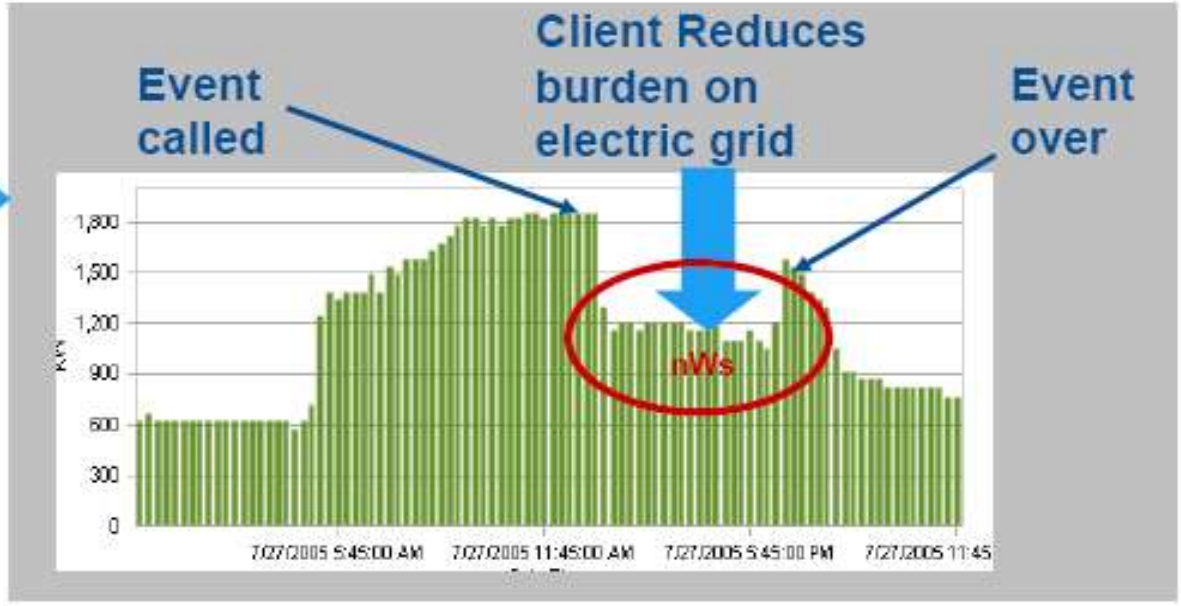
Turn off 1 of 4 elevators

Pre-cool building in early morning hours

Turn on emergency generator (can use as monthly generator test)

Turn off non-essential lighting

Grid Relief



EV: To Save Fossil Fuel & Reduce Pollution

- Petrol/Diesel is a scarce natural resource. (depleting)
- Li-ion Battery technology is driving EV industry: Substantial reduction in cost of battery. (Cost/KWH) $600 in 2012 to $250 / KWH in 2017 & $ 100 by 2022
- By 2030, only EVs to be manufactured in India (6% Peak by EV)
- Fuel Efficiency: 4W cars: 0.36 KWh/ Km, / Buses: 1 Kwh/ Km

EV Supply Equipment:

  - AC Slow Charging: (230 V, 1 Ph, 15 A with connector IEC 60309): 4-8 Hours
  - AC Fast Charging (415 V, 3 Ph, 63 A, connector IEC 62196): 40 min
  - DC fast charging system: < 10 min

Standard Connector: New connector J1772, by Society of Automotive Engineers: All major car companies have agreed to use.

- V2G concept: allows users of EV to sell back excess energy stored from their cars, to Utility

For a mid-segment car running cost of an For EV:Rs 1.5/Km, / For Petrol Vehicle: Rs 6/Km , / For Diesel vehicle: Rs 5/Km / CNG vehicle: Rs 3/Km

Challenges faced by EV Owners :

- **Distance anxiety**: Need Battery Recharging after 150-200 Kms, Traffic jam issues. Limited No. of charging stns.
  - Society Car parking facility may need a separate connection for EV charging (6-8 Hours: Slow charging)
- Higher initial cost: major impediment in EV Sector
  - Financing challenges: Limited financing options, high interest rate, high insurance cost, & limited loan opportunities.

Recent initiatives & various subsidies by GOI (FAME II) /All State Govts incentivise e-mobility drive

- Reduction Road Tax/Registration Charges/ EVs to have GREEN Number Plates/ Special lanes/ more Parking facilities
- Public Charging Stns (DC Fast Charging: 10 Min)/ Battery Swapping. Biggest Charging stn in Navi Mumbai: 21 EVs Dadar: 7 EVs at a time (3 Fast charging & 4 Slow Charging)
- Development of a new concept of Vehicle-to-Grid (V to G) to deliver power to grid, when RE Sources are not available (energy security)

Environment Performance Index (EPI) 2022

- India: lowest EPI rank among 180 countries in 2022 as per an analysis by researchers of Yale & Columbia University which provides a data-driven summary of the state of sustainability around the world. In EPI 21 India's rank was 178. EPI ranks 180 countries on 40 performance indicators including climate change, ENV, public health, biodiversity.
- EPI 2022:Top 10: Denmark,UK, Finland, Malta , Sweden . Luxembourg, Slovenia, Austria, Switzerland & Iceland . US is placed at 43rd rank.
  - India & Nigeria are in the bottom rankings. Their low EPI scores indicate need for greater attention to spectrum of sustainability requirements with high priority focus on critical issues such as air & water quality, biodiversity & climate change.
  - China, India, & Russia are headed towards the wrong direction with rapidly rising GHG emissions.
  - Destroying the ENV & nature in the name of 'development' should no longer be the path. Such an approach is just not tenable any more,
- Conclusions of EPI analysis: Efficient policy results are directly associated with per capita GDP. Economic prosperity makes it possible for nations to invest in policies & programs that help lead desirable outcomes

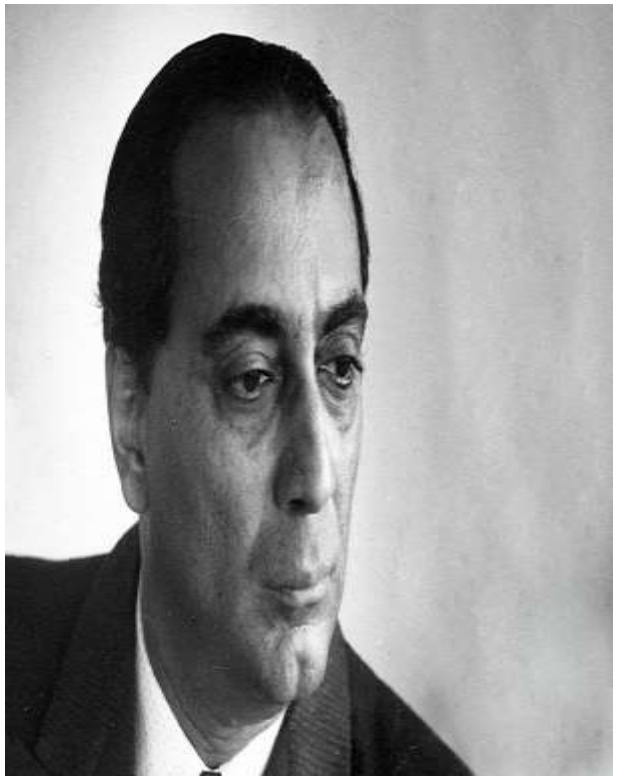
- **According to EPI analysis, developing countries do not have to sacrifice sustainability for economic security. Steps taken for climate action initiated by policymakers & stakeholders by them demonstrate that focused attention can mobilise communities to protect natural resources & human well being.**
  - **India has to immediately reduce carbon intensity of our economy, undertake large-scale & long-term science-based ecological restoration of all our diverse ecosystems which are inclusive in their approach & strengthen the resilience of our socio-ecological systems.**
  - **If the current trend continues, China, India, US & Russia, will account for over 50% of residual global GHG emissions in 2050**
  - **Other Asian countries: Pak, Bangladesh, VietNam & Myanmar have also similar issues**
- **Env Ministry, on June 8, said some of the indicators the EPI 2022 had used were extrapolated & based on surmises & unscientific methods & hence the EPI 2022 report is unacceptable to us**
  - **'Projected GHG emissions levels in 2050' is a new indicator in climate policy target. This is calculated using AVG rate of change in emissions over the last 10 years rather than modelling that takes into account a longer time period, the extent of RE capacity & use, additional carbon sinks, EE, & other factors in the respective countries. Historical data on the lowest emission trajectory has been ignored in the computation, it said while rejecting the analysis**

- Weight of the indicators in which India performed well has been reduced & reasons for such change have not been explained in report.
- "No indicator talks about RE, EE & process optimisation. The selection of indicators is biased & incomplete. Per capita GHG emissions contribute only a miniscule 2.6% weight overall in the index,
- The indicators on water quality, water use efficiency, waste gen per capita which are closely linked to sustainable consumption & production are not included in the Index, the ministry said.
- Index computes extent of ecosystems but not their condition or productivity. It did not include indicators like agro biodiversity, soil health, food loss & waste even though they are important for developing countries with large agrarian populations.

- P Chidumbaram: 'No Data Available' Govt.

(Authorities instead of rejecting the Report would have come out with the ground level achiements. Are there any authentic figurs avaialble with us?)

Thought for the day



"NO" Power

Is Costlier than

"No Power"

-- **Dr. Homi J Bhabha**

"For a developing country, like India "NO Power" Condition is the Costliest condition, as Electricity is the prime mover of development. So all effort need to be made for keeping POWER "ON" at any cost"